TECHNICAL OPERATIONS INCORPORATED

THE CIVIL DEFENSE ROLE OF RADIO BROADCASTING IN THE POSTATTACK PERIOD

by

M. Cocconi and D. Sommerberg

Final Report
Contract No. OCD-OS-62-31

Report No. TO-B 62-31
7 January 1963

Technical Operations Research
Burlington, Massachusetts

Submitted to

Office of Civil Defense
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Washington, D. C.

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FOREWORD

This report is the second of two being submitted to the Office of Civil Defense under Contract No. OCD-OS-62-31. The first report, "Fallout Protection for AM Transmitter Operators: A Study of the Selection of Stations to be Protected," Report No. TO-B 62-11, was prepared before the work statement was altered to redirect the research effort and deals with a selection procedure for singling out those AM radio stations that should be protected with fallout shelters. The present report reflects the redirection of the work effort and concerns itself with the requirements for mass communications in the post-thermonuclear attack period and the machinery and techniques for disseminating the necessary information. The report deals primarily with AM standard broadcast band radio, which was found to be the most suitable mass communications medium for the time period concerned and the objectives desired.

ACKNOWLEDGEMENTS

We wish to express our appreciation to Dr. James Buchanan of our Staff, who reviewed our drafts and offered many helpful suggestions and comments. We also wish to acknowledge the tireless technical assistance which we received from Mr. Donald Parker of Radio Station WBZ and Mr. Irving Robinson of Station WNAC, both of Boston. Mr. Joseph P. Ulasewicz of the Boston Office of the RCA Broadcast and Communications Products Division has been particularly helpful in defining the equipment and cost necessary for the establishment of a radio station. We are indebted to Mr. Arthur Burrell, Director of Civil Defense, Lexington, and his secretary, Mrs. Cammarata, for information about the plans and organization of Lexington Civil Defense.

ABSTRACT

This report concerns a study of the requirements for mass information dissemination following a thermonuclear attack upon the United States. The individual information requirements deemed necessary are listed, and AM radio is discussed as the logical disseminator of this information. The discussion centers on the existing AM standard broadcast radio network, including unique transmitters that might be located at emergency operating centers and on mobile radio stations. After the essentials of an efficient broadcasting system for the postattack period are determind, they are compared to those of the existing system. It is concluded that postattack information broadcasting is essential to the survival of the shelter population and may be accomplished by a modification of the present system, including the hardening of broadcasting sites and the addition, where necessary, of special-purpose transmitters. Recommendations for changing and supplementing the radio network of the United States are made.

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CHAPTER 1

INTRODUCTION

This is the final report on a study conducted by Technical Operations Research under Contract No. OCD-OS-62-31 of the function of radio broadcasting in the period following a thermonuclear attack upon the United States. The populace surviving the attack will need a great deal of information to survive the rigors of the post-attack environment laden with radiation from fallout. Beneficial psychological effects have also been attributed to efficient information dissemination, as shown by studies of major disasters in which improved morale and cooperation, as well as decreased friction, fighting, and hysteria, were evident when the population was well led and informed.

The whole subject of information dissemination to the population surviving an attack has been somewhat neglected to date. Our visits to local, state, and federal Civil Defense organizations as well as our conversations with people of the radio industry have indicated that little preparation or even planning has been given to this area. We have, therefore, received very little official guidance as to the actual recognized requirements for broadcasting, for the broadcast installation, and the broadcast reception. Based on our previous reports and experiences, aided by published reports of disaster studies, and inspired by our own conviction of the importance of post-disaster mass communications, we have attempted to outline the more crucial requirements and considerations involved.

We have evolved systematically a catalogue of information requirements deemed essential and highly desirable to the shelter population. Several schemes for disseminating this information have been examined and from these we have distilled the most crucial components of an efficient system. Our present day capability has been then examined in light of this required system, and recommendations for the upgrading and revision of today's capability generated. Finally, we have examined the population's ability to receive the broadcast information and recommended some positive steps to be taken to enhance the reception capacity of the shelter populace.

In our search for the ideal postattack information dissemination medium, AM standard broadcast radio suggested itself as the prime tool. Radio is in almost

every home today, it is universally available, and the people have become accustomed to its use. The range obtainable in the standard broadcast band makes radio suitable for broadcast to local communities and for cross-country relays as well.

We do not mean to imply that AM radio is perfect for our application; it has problems, but due to its overwhelming advantages it has been the principal object of our study. The main part of this report, therefore, concerns AM radio, although other means of communications are touched upon briefly.

Where it appeared that the discussion would be enriched by the application of an idea, concept, or scheme to a particular community, the Town of Lexington, Mass.,* has been so used. Lexington was chosen because of its proximity to Tech/Ops, its active Civil Defense program, and also because it is a suburban community and is therefore representative of the way in which a large segment of the population resides.

*See Appendix A for description of Lexington.

CHAPTER 2

REQUIREMENTS FOR INFORMING THE POPULACE

INTRODUCTION

We discuss in this chapter the various information items that should be considered for mass dissemination in a postattack environment. We are primarily concerned with information destined for a mass audience as opposed to "point-to-point" information for a selected audience. AM radio applications are included where the density of the point-to-point networks would require expensive and complex systems. Also, mass dissemination under some circumstances can provide backup to regular point-to-point networks.

It is important to remember that we address ourselves to the problem of postattack mass communications and not to the initial warning problem. This does not necessarily imply that the attack has been completed, but that it is either anticipated, or has started with the dropping of some (possibly most) weapons (in the case where the enemy has achieved surprise). This initial information has already been spread throughout the country by warning systems. The operational circumstance of our analysis, then, starts at that time when some of the general population is already in shelter with the rest hopefully on its way and ends at the time when full-time existence outside the shelter is practical, and recovery operations are well under way. We have divided this postattack period into three phases:

1. The Buttoned-Up Period
2. The Emergence Period
3. The Recovery Period.

The Buttoned-Up Period (BUP) covers the time in which the population is confined to shelter because of the high outside radiation level or because further attack is anticipated in the immediate future. The second period, the Emergence Period (EP), begins when some outside exposure becomes possible, so that the shelterees may leave the shelter for a short period of time, and ends at the time when a full workday outside the shelter is practicable. The Recovery Period (RP) continues until existence independent of shelters is possible and primary recovery operations are complete.

Since the incidence of an attack on the U.S. will vary from complete destruction for some localities to no direct effects from either weapons or fallout for other localities, the length of time of each period will vary considerably depending on locality. For example, in localities receiving no direct effects of weapons, the BUP period should last only until no further weapons are expected and freedom from fallout is established. Since very little radiation has been experienced, the problems of adjustment associated with the period of radiation decay should be trivial.

We expect, then, that the requirements for mass information dissemination will vary considerably from locality to locality depending on the circumstances of weapon damage and fallout. On the other hand, a large number of requirements will be independent of damage level. We have categorized the information required into four broad types:

1. General war news, statements from government officials (President, governors, etc.), entertainment
2. General instructions (first aid, radiological procedures, fire control, shelter, etc.)
3. Specific instructions (warning of hot areas, available shelter, remedial evacuation, etc.)
4. Point-to-point communication backup.

Requirements for types 1 and 2 are essentially independent of the level of damage; requirements for types 3 and 4 are closely associated with the level of damage and casualties. We anticipate that the type 3 and 4 requirements will also vary according to urban, suburban, or rural community, partly because of the different problems each community faces and partly because of the differences in shelter type and availability. This is not true of types 1 and 2; it is feasible, therefore, to prerecord the bulk of these messages and stockpile them at stations. We anticipate that in general both community and private home shelters will be used, but that more densely populated areas will have a relatively greater number of community shelters. Our analysis is oriented towards the suburban community of Lexington, where currently existing structures could provide community shelters for about two-thirds of the total population.

We have interviewed a number of CD workers at regional, state, sector, and local levels and radio people in the Boston area. In addition, we have analyzed the reports and studies of large disasters that have occurred in recent years, including the Japanese nuclear detonations. Although these sources have provided valuable background information, no real authoritative source exists to our knowledge for the mass information requirements of a community under nuclear attack. The list compiled here represents our considered opinion.

FALLOUT ADVISORIES

SAFE EXPOSURE TIME

During the early part of the Buttoned-Up Period, there will probably be no "safe exposure time." That is, radiation will be so high that total shelter confinement will be indicated. Frequent announcements to this effect should be made. Occupants sheltered under uncomfortable conditions or in an offensive environment (such as with people ill with radiation sickness) might try to escape their own shelter to seek sanctuary elsewhere. They also might try to leave to search for family members. People must be discouraged from attempting any such moves that might expose them to a lethal dose of radiation.

When the radiation level has decayed sufficiently to allow short trips from the shelter, announcements should be made at frequent intervals to allow shelterees some exercise, fresh air, and short but necessary trips. Announcements must stress the importance of adherence to time restrictions in any trips away from the shelter.

People in those areas experiencing no fallout should be encouraged to forsake their shelter and join organized efforts to assist the damaged and/or heavy fallout areas.

FALLOUT FORECASTS

Forecasts of local radiation levels should be broadcast frequently to facilitate planning by the shelterees. Forecasts should not be in terms of r/hr, but rather in terms easily understood by the populace. Convenient ways of communicating the radiation hazard would be in terms of: number of days remaining until exposure of

a few minutes will be possible; number of days remaining until exposure of a few hours will be permitted; etc. Where radiation levels are already high or expected to become very high, people should be urged to improve the protection factor of the whole shelter, or even part of the shelter, to reduce the dose received within. If new radioactivity is expected after the initial deposit of fallout has begun to decay, the populace should be so informed and warned to plan on a longer confinement.

Fallout advisories become even more significant during the Emergency and Recovery Periods, because many people will be exposed to radiation for the intervals of time based on these advisories.

WARNING OF HOT SPOTS

If hot spots should develop in areas where people are sheltered, they should be instructed to evacuate to less contaminated shelters. The timing of an announcement of this nature is quite critical, for people must be told to remove to a better shelter long before they are in danger of obtaining a fatal dose in their present sanctuary. In the final days of the Buttoned-Up Period, knowledge of hot spots will be important so that people may avoid these areas in their planned brief excursions. Hot spot announcements should be broadcast in conjunction with safe exposure-time proclamations.

Admonitions to avoid dangerously radioactive regions should be broadcast frequently during the Emergency and Recovery Periods, until these areas can be cordoned off or otherwise rendered inaccessible.

FOOD AND WATER DISTRIBUTION

LOCATION OF FOOD AND WATER

Reports of the locations of stores of food and water are not of much consequence during the BUP period, since the shelterees are not at liberty to avail themselves of remote supplies. The knowledge, however, that these supplies exist and will be available as soon as short trips from the shelter are possible may be reassuring and serve as a morale booster. For this reason, we advocate occasional announcements of the location of "safe" food and water supplies. In the final phase of the

BUP period, shelterees close enough to one of these stores may be able to send out one or two men to bring back items in short supply in the shelter.

In the Emergency and Recovery Periods, however, information gained from these announcements will be put to extensive use. Every effort should be made to make these bulletins as detailed and timely as possible. Unsuccessful forage trips to exhausted depots or stores already depleted of the needed items must be prevented (primarily to keep exposure to a minimum).

DECONTAMINATION OF FOOD AND WATER

It is not very likely that contaminated food or water would be found in a fallout shelter. The priority of instructions for the accomplishment of food decontamination is therefore quite low. However, toward the end of the BUP period, it would be useful to instruct people in the techniques of decontamination so that they may be ready to go to work upon emergence from shelter. Group efforts should be encouraged.

Decontamination instructions should be given frequently during the EP when decontamination activity will be at its peak. By the time of the RP, decontamination of available food stocks should be virtually completed, but problems relating to agriculture and livestock maintenance will be coming to the forefront. Broadcasts should then be redirected to guide farmers in their planting, harvesting, etc., (depending upon season) and their meat, milk, egg, etc., production.

IDENTIFICATION OF SAFE FOODS

Since foraging for food is not possible during the BUP, there is no urgency to disseminate information about "outside" foods that may be safely consumed. Before emergence, however, the shelterees should be briefed on this subject so that prompt selection of available food stores may be made during brief trips from the shelter.

To assure utmost utilization of available consumable food supplies, detailed instructions should be broadcast frequently in the EP and RP. People will probably be reluctant to consume food, even though packaged, which has stood on grocery shelves through several days of exposure to radiation. The safeness of canned and well-packaged foods must be impressed upon the populace.

PREVENTION OF HOARDING

With proper shelter management, there should be no hoarding of food or other essential supplies during the BUP. Nevertheless, upon emergence people would be tempted to accumulate essential items in excess of their actual needs for fear of future deprivation. If available supplies are to be stretched to provide for all who need them, the population must be urged in the strongest terms to take only what they require and no more. Messages to this effect should be broadcast frequently just prior to first emergence, throughout the EP, and until food supplies again regain normalcy in the RP.

CARE OF SICK AND WOUNDED

LOCATION OF EMERGENCY HOSPITALS

Unless fallout is very light, it is not likely that any movement of the sick or injured will be possible during the BUP. Prior to emergence from the shelter or during the BUP when short movements in low fallout areas are possible, locations of all hospitals and emergency medical centers should be announced periodically, so that those in need of medical attention may be attended as soon as possible.

During the EP, locations of medical facilities should be announced more frequently. If some of these installations are filled to capacity or overloaded, prospective patients should be directed to less crowded centers. Hospitals or first aid stations specializing in specific cases or especially well-equipped to treat a particular ailment should be made known to the public (for example, one installation may be better equipped to store whole blood than another).

EMERGENCY FIRST AID INSTRUCTIONS

Instructions in emergency first aid and medical procedures will be important to shelterees confined without doctors or nurses. Although some shelters will undoubtedly have among their population medically-trained personnel, many will not, and it is these people who will be most helped by medical messages. For example, Lexington, in 1961, reported 991 cases of communicable diseases (38.1 cases for a 2-week period) and 392 babies born (15 births for a 2-week period).

The chance of such a medical emergency occurring within a shelter in a 2-week confinement is quite good. A captive audience could readily be instructed via radio to cope with these emergencies. Medical self-help messages can be prerecorded and stockpiled at radio stations.

First aid instruction via radio should continue throughout the EP and into the RP, for minor injuries can be expected to occur both in and out of shelter, and these can be treated locally, thus sparing the already overtaxed hospitals. It is not anticipated that this type of training will produce first aid experts, but at least some familiarity and perhaps proficiency will be instilled. People should be able to learn by this means how to recognize and treat the most common injuries and infirmities, to stop bleeding, prevent and alleviate shock, administer artificial respiration, and treat burns. Some instructions in midwifery might also be appropriate. Recordings could be uniquely identified and prescheduled for broadcast on command by CD authority.

LOCATION OF EMERGENCY MEDICAL SUPPLIES

The broadcasting of the location of emergency medical supplies should be accomplished during the last day of the BUP to indicate to forage parties where needed medical supplies might be found and should continue throughout the EP and RP so that exhausted medical stocks may be replenished from depots.

CALLS FOR BLOOD DONORS

Since whole blood is imperative in the treatment of radiation sickness but cannot be stored for too long a period of time, it would be wise to secure a supply of blood at the beginning of the postattack period (or before) when some movement of people and supplies is still feasible and again at the earliest moment at which decay of the fallout level will permit movement of donors. Broadcasts for donors should be timed accordingly.

CALLS FOR VOLUNTEERS TO MAN EMERGENCY HOSPITALS

Medically-trained personnel who have not been preassigned to emergency hospitals should be directed to these hospitals in the preattack and the immediate postattack period. Once shelterees are able to leave their shelters for a few

minutes, those in need of medical aid will seek out the emergency hospitals. With the load thus increased, it seems reasonable to expect that these hospitals will need additional trained and untrained personnel to tend to the sick and wounded. Calls for volunteers to aid in hospital work should be initiated when it becomes apparent that the hospitals are becoming overloaded. The fallout-free areas, in particular, should be canvassed for volunteer help, since trained medical personnel from these areas can most easily be spared.

NEWS OF THE ATTACK AND COUNTERATTACK

A review of disaster research literature has revealed that confined populations require news from the "outside" to:

1. Prevent the fermentation of rumors
2. Prevent panic
3. Improve morale
4. Instill a feeling in people that this is not a personal disaster but that the whole population of the nation is included
5. Prepare people for the conditions they will encounter upon emergence.

Obviously "good news" would be most encouraging and helpful in its influence, but even bad news is superior to no news, since it too helps to define the environment and diminish uncertainty. Regions unaffected by the attack should also be kept up to date on developments in the rest of the country, so that relief and rescue operations may be tailored to the existing situation.

SELF-HELP INSTRUCTIONS

The morale of a confined unemployed group deteriorates. Self-help instructions can help to fulfill the need of shelterees for something to do and also will tend to induce people to improve their situation. Self-help instructions should be largely prerecorded and broadcasted frequently. Instructions will have to be tailored to the changing needs of the community as it progresses from the BUP to the EP and

finally into the RP. The nature and content of these instructions will be varied, and different sets of experts will be called upon as the people emerge. Different shelter groups may be selected for training in various skills to effect recovery most expeditiously.

USE OF THE DOSIMETER TO CALCULATE SAFE EXPOSURE TIMES

Although many people will be already trained in the use of dosimeters and other radiation measurement devices, there is no guarantee that one of these trained people will find his way to each of the shelters equipped with such instruments. It seems useful, therefore, to broadcast instructions in the use of these instruments and also in the interpretation of the readings. Because fallout is subject to a great deal of variation within even a small broadcast area, it is necessary that shelterees be able to calculate for themselves the safe exposure times for their own immediate area. Instructions should be continued from the beginning of the BUP through the EP, to assist the emergent population in the calculation of safe exposure times. Presumably there will be no requirement for such messages in the RP, unless some work is required in residual hot spots.

SANITATION

Proper sanitation to prevent disease and epidemics is imperative under the crowded and sub-optimal living conditions that would prevail in most shelters. Shelterees should be reminded periodically to uphold as nearly as possible peacetime sanitation standards and habits. Instructions for correct use of sanitation equipment provided in community shelters should also be disseminated. The emerging population will most probably be faced with sanitation problems of all sorts, some of which will be caused by the lack of electrical power, water, sewage disposal and processing facilities. Until these utility functions are restored, the populace will have to be instructed in interim measures. Pest and rodent control may also require some special instructions.

SHELTER MANAGEMENT

The significance of efficient leadership in a shelter situation, particularly at the start of the confinement period, has been well documented in the disaster research literature and is now clearly recognized.[1,2,3] Although many volunteers

are being trained as shelter leaders, one cannot be certain of the presence of a trained leader in each community shelter. It is probable that in those shelters in which there is no appointed leader, an elected or self-appointed leader will assume command. Although these leaders might be able administrators, they would lack the special knowledge and skills required of a shelter leader. Some of this void could be filled by periodic broadcasts of instructions to shelter managers. Even trained managers would benefit from this refresher course. Shelter management instructions will retain much of their import in the EP, when shelter activities should be closely coordinated with "outside" endeavors to make this outside work as productive as possible. Where point-to-point two-way communication between shelters and the EOC is available, AM Radio should be employed as a back up to the existing means of communications.

RATIONING IN SHELTER

During the early hours of the BUP, it will become apparent just how long a shelter confinement is indicated for the broadcast area. Rationing of food, water, and other shelter supplies should be based on this estimate. Periodic announcements of rationing procedures should be made, as well as every effort to reassure shelterees that subsistence on minimum rations is possible for the indicated confinement period. It may be assumed that some shortages of food and other survival items will persist well into the EP and perhaps into RP. Rationing would thus continue for a considerable period of time, and radio will be the most convenient medium for dissemination of ration regulations, allowances, and locations of places of dispensation.

DISPOSAL OF DEAD

During the period of shelter confinement it may be expected that some people will die of natural causes,* others due to blast or thermal injuries, and others perhaps due to radiation sickness. Death in the shelter can present special problems. The very occurrence of a fatality has a demoralizing effect on the group.[2] This,

*In Lexington there were 352 deaths in 1961, leading to the expectation of approximately 14 deaths during a 2-week shelter confinement.

together with the sanitary considerations involved, indicates a prompt removal of cadavers from the shelter. Occasional instructions to shelter leaders on the disposal of the dead would be useful. This problem will probably become most severe during the EP. Instructions for the collection and disposition of the dead will have to be broadcast. If, as at Nagasaki,[4] coffins are unavailable, cremation may be indicated. Vehicles and volunteers to accomplish this job will have to be recruited. Some means of identification, registration, and notification of next of kin will have to be devised and disseminated.

MORALE-BOOSTING SPEECHES AND MESSAGES

SPEECHES BY THE PRESIDENT

The morale-boosting value of encouraging talks by national leaders was amply demonstrated during World War II, particularly in Great Britain where Prime Minister Churchill's addresses had a remarkable effect after Dunkirk. In a letter to the FCC dated 25 January 1962, Pierre Salinger, the Presidential Press Secretary, conveyed to the Commission the President's requirement that all necessary provisions be made to carry his speeches to the American people in case of a national emergency. These speeches should be initiated as soon as a national hookup can be effected and be continued well into the recovery period.

SPEECHES BY LOCAL LEADERS

The particular morale-building value of reassuring radio talks by local leaders lies in the feeling being conveyed to the shelter dwellers that here are people whom they know and respect and who are their elected local leaders "in the same boat" as they are but not discouraged. Additional value may be gained by references to local lore, heroes, public figures, etc. After the BUP, these talks should serve to inspire the populace in its efforts toward returning the community to normalcy. Pride in the community, country, and individuals could be stressed.

SPEECHES BY STATE LEADERS

Speeches by state leaders have an effect similar to that already described for federal and local leaders. Since usually the State Emergency Operating Center is connected by a direct line to an entry point into the state's emergency broadcasting

system, speeches by state executives and other leaders could be readily disseminated. Some prerecorded talks could be stockpiled at the radio stations.

ENTERTAINMENT

Some entertainment should be furnished the shelter population during the long hours of confinement.[1] People with battery-operated radios, however, should be advised to conserve their batteries and listen only to a minimum amount of nonessential program material. The entertainment broadcasts should be continued throughout the EP and the RP, for it is believed that music properly chosen may substantially aid morale in the rebuilding phase.

FUEL AND POWER

SOURCES OF FUEL, LIQUID AND SOLID

The location of stockpiles of fuels should be made known to shelterees before their first trips from shelter so that low fuel supplies may be replenished for the remainder of the shelter confinement. As the reconstruction process progresses, fuel will become more essential,and new and replenished sources should be made known as soon as possible. Conservation should be urged continuously in fallout areas as well as in unaffected regions.

POWER RATIONING, HOURS

If commercial power should be available during the BUP, it is conceivable that it might be in short supply. To conserve the power available, hours of usage by various shelter complexes might be broadcasted. Power allocation will become most important during the recovery phase, however. It is then that frequent broadcasts of the rationing regulations would be in order.

CONTROL OF FIRES

CALLS FOR VOLUNTEERS FOR CONTROL OF FIRES

It is not likely that any fire fighting will be possible during the BUP. Nevertheless, volunteers and auxiliaries might be urged to assemble at specific sites, once exposure for short periods becomes possible, so that they might be deployed

for fire fighting duty when radiation levels permit. Radio may be used by fire-threatened communities to solicit fire fighting equipment and personnel from radiation- and damage-free regions. Fire brigades may also be requested to pump fresh water into exhausted community water tanks.

WARNING OF FIRES CLOSE TO SHELTERS

If it is known that fires are spreading into areas in which shelters are located, the shelterees should be alerted. If remedial evacuation to another shelter is indicated, instructions for the accomplishment of this movement should be disseminated via radio. This sort of movement will, of course, be safer after the BUP, but in some instances the situation (fire hazard to the population) will indicate that action is to be taken regardless of radiation hazard.

RE-ESTABLISHMENT OF NORMAL LINES OF COMMUNICATIONS

Very little, if any, action to restore normal communications will be feasible during the BUP. However, courses of action to be taken upon emergence can be outlined to the populace at this time.

Efficient communications would certainly be a great convenience and asset in the reconstruction effort.[2] Therefore, every effort should be made toward the normalization of communications channels such as local and long distance telephone, telegraph, radio network facilities, state police radio networks, etc. Radio might be used to call upon military equipment and crews to fill gaps and also to call repair experts from unaffected communities, such as telephone repairmen, into the disaster areas.

TRANSPORTATION CONTROL

RE-ESTABLISHMENT OF PUBLIC TRANSPORTATION

The re-establishment of public transportation should be given priority in the EP. People must be provided with transportation from their shelters to places of work (when walking is not feasible), and tools and supplies also must be conveyed. Vehicles of mass transportation seem to offer the most economical and efficient means to this end, for they consume less fuel and cause less traffic congestion than cars.

Call for Drivers

Drivers may be recalled selectively as needed from regions in which emergence for the period necessary is possible.

Announcement of Schedules

Schedules of reinstituted runs would receive the widest dissemination via radio.

FUEL RATIONING

Details of the motor fuel rationing scheme may easily be disseminated by radio. Unaffected areas should be urged to conserve gasoline, oil, and diesel fuel.

RESTRICTED AREAS

The utmost publicity should be given to restricted areas inaccessible to the public for reasons of radiation hazard, cave-in, unsafe buildings, military operations, etc. Uncontrolled convergence upon the disaster area by sightseers, anxious family members, and helpers, should be discouraged.[5]

RE-ESTABLISHMENT OF NORMAL COMMERCE

Announcements relating to the resumption of commerce belong primarily in periods following the BUP. During the shelter period, however, people might be apprised of the rules and regulations that will apply upon emergence, so that they will know what to expect concerning the medium of exchange, whether the needy will be allowed to take what they require without being charged with illegal looting, and other matters. As society is gradually reconstituted, the medium and method of exchange may be altered and again the populace must be informed of the situation. Similarly, a different standard may be expected in the unaffected regions whose residents must be kept up to date on their own regulations. Commerce between the two zones may have to be regulated, and people should know what rules are in effect.

CALLING NATIONAL GUARD TO DUTY

It is assumed that during the emergence and recovery periods it will be necessary to augment local and state police by National Guard troops to assure public

safety. Just before emergence, calls for members of the National Guard could be initiated, giving planned reporting times and places.

CARE OF DISPLACED PERSONS

LOCATION OF DISPLACED PERSONS CENTERS

A thermonuclear attack upon the United States will leave many people homeless and will displace others from their homes for various periods of time. Many families will be separated and their homes destroyed. For these displaced persons there will be camps or shelters of one sort or another set up by local, state, or federal government, or perhaps by the American Red Cross. Announcements of the location of the closest DP Center should be made before emergence and continuously into the RP.

REUNITING OF FAMILIES

For members of families separated from each other, broadcasts of lists of names of people safe in various shelters as well as lists of casualties would be helpful. This might be possible in smaller communities. In larger towns or cities or where radio stations must serve several communities, the locations of DP Centers should be broadcast so that family members may have a convenient place for reunion. Since we have become a nation of peripatetic salesmen, job-seekers, vacationers, etc., it is probable that many people will be detained by the attack at a considerable distance from family members. If telephones are not available or overloaded, perhaps some relaying of lists of safe wayfarers could be accomplished by radio stations during the night hours.

DIRECTION OF REMEDIAL EVACUATION

Remedial evacuation would most probably not be attempted in the BUP. However, the following announcements to prepare the shelterees for evacuation might start prior to emergence:

1. Designation of area to be evacuated
2. Designation of reception area
3. Designation of time to evacuate

4. Designation of means of transportation

5. Designation of route to follow.

Instructions should be explicit, but easy to follow and all-inclusive.. Punctuality and strict adherence to the instructions should be emphasized. Residents of the reception areas should be prepared for the influx, and law enforcement officials in the intermediate regions should be prepared for the transit of the evacuation vehicles through their zones.

WARNING OF ANOTHER ATTACK

Warning of impending attack may be most easily disseminated by radio. Advance knowledge of attack will give shelterees time to make whatever preparations necessary or possible for a local attack. Knowledge of a distant attack but one that will bring additional fallout allows shelterees to plan more realistically for an extended shelter stay.

INSTRUCTIONS TO LOCAL CIVIL DEFENSE FORCES

In communities without point-to-point CD communications equipment or where such equipment is inoperative, the dissemination of instructions to CD personnel over AM radio should be considered. In areas such as the Plain States, where the population may be scattered over large distances requiring long CD lines of communications, the extended range of AM radio is a decided advantage and provides an economical means for CD communications. Even after people have emerged from shelter, general broadcasts to CD forces deployed over a wide area may be useful.

RELAY OF CIVIL DEFENSE MESSAGES

The relaying of Civil Defense messages from one CD jurisdiction to another, from one state to another, or even from a local to a national headquarters can be accomplished by proper planning. If each AM station were to monitor one or two other stations, messages could be passed quite easily. When this procedure extends in several directions, dispatches can be passed across the country within a reasonable period of time.

DIRECTING PEOPLE TO SHELTER

Some people may be delayed in their search for shelter, perhaps because they were in the country, at the beach, or looking for family members. These stragglers, although already exposed, should be urged via radio to seek shelter immediately and should be apprised of shelter locations every hour or so throughout the early period of the BUP.

DATE, TIME, BROADCAST SCHEDULE

Because people confined to shelter, to whom one day may seem like the next, would have a tendency to lose track of time and date, it would be useful, particularly in the BUP, to periodically refer to the date and time of day. In conjunction with these announcements, the broadcast schedule should be given frequently so that those with battery-operated receivers may conserve their batteries for more vital broadcasts.

SUMMARY DISCUSSION OF REQUIREMENTS

We have estimated in Table 1 the broadcast duration and frequency for the information items discussed, for the three successive periods, BUP, EP, and RP. The forty individual items have been arranged in sixteen categories. A 24-hour broadcasting day has been employed as a basis for extending total time requirements for items broadcasted more frequently than once a day. The estimated time and frequency for each category are based on content and priority. Four categories—Speeches, Warning of Attack and Fire, Calling of National Guard, and Direction of Remedial Evacuation—have been assigned neither duration nor frequencies but are called "pre-emptive" categories for broadcast whenever the situation warrants an interruption in the scheduled program.

Categories other than pre-emptive ones have been grouped by the source of the material (local, state, and national). The approximate total time required by local, state, or national sources is as follows:

Program Source	BUP	EP	RP
Local	1 1/2 - 3 1/2	2 - 4	1 1/2 - 4 hours
State and National	3 1/2 - 5	6 - 7	4 - 5 hours

TABLE 1

DURATION AND FREQUENCY OF BROADCAST MATERIAL FOR 24-HOUR BROADCAST DAY

	Broadcast Information	BUP			EP			RP			Program	
		Time (min)	Freq (day)	Total (day)	Time (min)	Freq (day)	Total (day)	Time (min)	Freq (day)	Total (day)	Live	Record
LOCAL	Fuel, Food, and Water Locations	*			2	6	12	1	12	12	x	
	Locations of Hospitals and Hospital Supplies	*			1	4	4	1	4	4	x	
	Calls for Volunteers				5	1-4	5-20	5	1-4	5-20	x	
	Recovery Activities	5	1-4	5-20	60	1	60	60	1	60	x	
	Directing People to Shelter†	5	12	60							x	x
	Fallout Advisories	1	4	4	2	4	8	1	2	2	x	
	Displaced Persons	10-30	1	10-30	10-30	1	10-30	10-30	1	10-30	x	
	Instructions and Relay for CD Forces†	15	2-6	30-90	15	2-6	30-90	15	2-6	30-90	x	x
	News, Local	3	6	18	1	6	6				x	
	Total Local Scheduled	109 - 204 min			130 - 224 min			123 - 218 min				
STATE & NATIONAL	News, Date, Time	5	24	120	5	24	120	5	24	120	x	x
	Self-Help Instructions	30	4	120	30	2	60	30	1	30		x
	Shelter Management	30	1	30	20	1	20	10	1	10	x	x
	Fallout Advisories	3	8	24	3	8	24	3	1	3	x	
	Displaced Persons	40	1	40	40	1	40	40	1	40	x	
	Instructions and Relay for CD	15	2-6	30-90	15	2-6	30-90	15	2-6	30-90	x	x
	Entertainment	Fill in available time									x	x
	Total State and National Scheduled	224 - 284 min			354 - 414 min			233 - 293 min				
PREEMPTIVE	Speeches	AS REQUIRED									x	x
	Call National Guard										x	
	Direction of Remedial Evacuation										x	
	Warning of Attack and Other Hazards										x	

*No continuous requirement. Information should be broadcast on the last day of the BUP, with duration and frequency given in the EP.

†Localities not having established or having lost point-to-point radio communications would have a requirement for regular broadcast of instructions to CD Forces.

These totals do not include pre-emptive categories or entertainment. The time allocated to "local" applies to the requirements for one locality. Two localities would double the requirement, etc. Entertainment enters as a filler between other programs. Some programs such as Shelter Management, Instructions, and Relay for CD could be broadcast during the sleeping hours. Other categories such as news and fallout advisories should be programmed around the clock.

Some of the material could conceivably be disseminated by means other than radio, if available, or in some cases a general education program could provide some necessary information long before an attack. We refer to self-help instructions and shelter management, for example. No general education program exists or is planned, however, and, furthermore, other means such as circulation of preprinted matter is impossible in the BUP and difficult in the EP. The other categories are characterized by their extreme perishability, since the value of the information decreases rapidly with age. Under these circumstances we feel that voice radio communications in some form are required to carry the data.

CHAPTER 3

REQUIREMENTS FOR ACHIEVEMENT OF PUBLIC INFORMATION

In the previous chapter, we have discussed what the population should be told in the postattack era. In this chapter, we are concerned with how this information is to be conveyed. Using as a point of departure the commercial radio network existing today, we consider the possibility of associating an AM station with a CD Emergency Operating Center (EOC), the employment of a public address system that uses either telephone line or radio transmission, and the use of supplemental mobile transmitting stations.

AM COMMERCIAL RADIO

Federal Communications Commission Chairman, Newton Minow, made the following statement at the CBS Radio Affiliates Meeting in New York:

> "Radio is America's roommate because it's so downright companionable. It goes places, it does things. And above all, it always takes us along... A recent radio study made use of the "grim rumor of war" research question. As one might expect, seven out of ten people questioned said that they would turn on their radios to verify a report that war had broken out."[6]

Disaster studies such as those of the Waco and San Angelo tornadoes,[7] the fallout shelter attitude study,[8] and the Pittsburgh shelter experiment[1] point out the important role of radio after a disaster. Radio can inform, entertain, soothe or incite, comfort, and cajole. But radio is only a tool for the conveyance of information. Proper planning of broadcasting facilities, material, and equipment is essential if radio is to fulfill its postdisaster role. People must be trained to properly avail themselves of the service radio can offer and also to provide that service. Plans must be laid to ensure the presence of operators at their stations when the time comes. Radio suggests itself as the obvious postdisaster information voice and its merits and limitations in this respect should be considered. We therefore present in this chapter some of the advantages and disadvantages of radio

as a postattack information medium. It should be realized that some of the items discussed are not advantages or disadvantages of radio per se, but rather reflect the status of the industry today.

ADVANTAGES

Wide Coverage

Radio, being a commercial industry, is concentrated in areas of high population, although virtually all communities of the United States are within range of some radio station. The statistics of the radio industry are impressive.[9] In 1961, there were 3693 commercial radio stations on the air, a sharp rise from the 913 stations at the close of World War II (1945). In 1962, there were 184,000,000 sets in working order, resulting in 97.9% of American households having at least one radio in working order.[10]

Table 2 shows the distribution of households as a function of the number of radio sets in working order. No direct estimates of the total number of portable

TABLE 2

DISTRIBUTION OF HOUSEHOLDS BY NUMBER OF RADIO SETS*

Number of Sets in Working Order	Per Cent of Households with Sets in Working Order
1	54.7
2	26.8
3	10.9
4	4.9
5	1.7
6 or more	1.0

*Electronic Industries Association, "Electronic Industries 1962 Yearbook" (1962).

(battery operated) sets are available. In 1961, however, 48% (5.4 million) of the 11.2 million radio sets (excluding automobile radios) sold to retailers by American producers were portables.[9] The 10.7 million home sets imported during the same year were not classified by power supply, but they include 10.3 million radios with three or more transistors. Approximately 34% of the domestic radios sold to retailers during the past ten years were portable sets.

Radio Receivers and Batteries Relatively Inexpensive

With the influx of cheap battery-operated radios from Japan, the cost of radios has dropped so that two transistor portables may now be purchased for less than $6.00 and six transistor sets for less than $13.00.[11] These radios will run on a set of batteries (costing up to $1.20) for 50-300 hours depending upon current drain. It is now possible for the citizen to stockpile in his shelter a battery-operated radio with a set of spare batteries for less than $8.00. This surely puts a portable battery-operated radio within reach of most people who do not already possess such a set. For the really economy-minded, there are crystal sets selling for as little as $1.49,[11] which, of course, require no batteries and are perfectly adequate in areas close to transmitters.*

Long Broadcast Range

Being in the MF band in which radio waves are bent around the earth by diffraction, AM standard broadcast radio transmission over a considerable distance is possible. The actual range to which an intelligible signal may be broadcast is a function of transmitter power, antenna location, height and pattern, terrain features, receiver efficiency, frequency, and atmospheric conditions. The daytime pattern of Station WBZ, a 50 kW clear channel station located in Boston with a 520 foot transmitter tower near the ocean, extends for over 200 miles in some directions. Because of nighttime atmospheric changes, it is possible to propagate radio signals for 1000 miles and more. Thus, it is possible, with radio, to relay CD messages over long distances employing just a few radio stations.

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*These sets need a good outside antenna and an adequate ground.

Station Distribution

Radio stations are well distributed around population centers, where patterns are set up to reach the most people. Cities normally have a large number of radio stations: Boston has 14; Detroit, 8; Minneapolis-St. Paul, 14; New York City, 17. Rural areas, too, are well covered. The fact that approximately 98% of American homes[10] have one or more radios indicates that virtually all Americans are within range of one or more radio stations.

AM Networks in Existence

Network hookups are, of course, a convenient means of disseminating information throughout the nation. There are today five major networks in existence with which 2341 stations are associated,[11] representing 63% of all AM stations. In addition, there are numerous smaller networks such as regional networks, group ownership stations, etc. National hookups of virtually all AM stations are possible through the Bell system.

FM Emergency Networks

Statewide FM emergency networks assure dissemination of signals throughout the states. A number of states such as Massachusetts and New York have FM networks in existence whose function is to relay signals to the AM stations throughout the state. Thus, it is possible to introduce a signal into one FM station and have it reach all AM stations (CONELRAD) via FM relay and off-the-air pickup. There are also several commercial interstate and intrastate FM networks, such as the QXR network originating in New York City that broadcasts up and down the Northeastern and Middle Atlantic states. Although FM transmission is limited by line of sight, there are now sufficient FM radio stations (960 stations in 1961) to cover most of the country and to saturate the high population areas.

Radio Personnel in State Industry Advisory Councils

There exists a core of Civil Defense oriented and interested radio people in the various State Industry Advisory Councils. (The National Industry Advisory Council and its adjuncts, the State Industry Advisory Councils, advise the FCC on defense matters.) Thus, a small group of well-trained radio personnel are available to advise and participate in CD matters.

Radio Accepted as News Source

Radio has for the last 4 decades provided the nation with news—good and bad. Most radio stations provide news broadcasts once an hour, with special bulletins as necessary. The wide publicity given to the two CONELRAD frequencies of 1240 kc and 640 kc has further reinforced the association in people's minds of radio with disaster news. People are already conditioned to listen to the radio for disaster information. This was illustrated in the study of the 1955 California floods[12] in which 80% of the people interviewed stated that radio was their preferred means of obtaining news, weather, and flood news. Moore also ascertained this preference in his Austin, Texas survey[8] in which 64.5% of all respondents indicated that their first action upon hearing a warning signal is to turn on their radios.

DISADVANTAGES

Vulnerability of Telephone Lines

The communications links between radio studios and their transmitters and also the present links from EOC's to radio stations are telephone lines. Even if these lines are not knocked out by the attack, lines passing through exchanges or switching centers will eventually go out due to lack of maintenance.

Lack of Fallout Shelters for Radio Facilities and Personnel

At present there are no known radio stations with adequate fallout shelters at either the studio or transmitter site. Although a program is being initiated with Federal 1962 funds to equip 76 stations with shelters, this number is but a small fraction of the 3693 stations now operational. Even if this program is continued at the present pace, it will be several years before fallout protection is accorded to sufficient stations to cover the population of the U.S.* The current program, which calls for 150 sq ft of shelter per radio station, seems unrealistic without supplementary procedures or shelters to provide for the families of the radio operators, engineers, and maintenance crews. To maintain 24 hour operation, two or three crews will have to be stationed at each facility. It is difficult to see how such staffing will be available unless these people have reasonable assurance that dependents are in safe shelters either at the station or elsewhere.

*The effectiveness of this program is further diminished by the withdrawal of the requirements to stock these shelters.

Lack of Proper Emergency Generators

Not all stations have emergency power generators and those that do can broadcast only on reduced power when employing these generators. Table 3 gives the emergency power information for the ten major Boston Stations. Thus, coverage (particularly at night) when commercial electric power is unavailable is seriously reduced. The 50 kW stations usually broadcast at 5 kW power on their emergency generators (according to present CONELRAD FCC regulations), thus reducing their power tenfold. This reduction is power and volume affects the intelligibility of the signal due to the lowered signal-to-noise ratio (a 10 db drop for the reduction). The power reduction of smaller stations is not usually as severe as that for the 50 kW stations, but is still significant in terms of coverage loss.

TABLE 3

BOSTON AREA 5 kW - 50 kW RADIO STATIONS

Call Sign	Transmitter Power	CONELRAD	Emerg. Power
WNAC	50 kW	ALT	YES
WCOP	5 kW	YES	YES
WEEI	5 kW	YES	YES
WHIL	5 kW	NO	YES*
WORL	5 kW	NO	YES**
WBZ	50 kW	YES	YES
WMEX	5 kW	ALT	YES
WEZE	5 kW	YES	YES
WBOS	5 kW	NO	NO
WHDH	50 kW	NO	YES

*Emergency Generator has never been operated.

**Emergency Generator not yet installed and emergency transmitter not yet purchased.

Lack of CD Plans for the Radio Industry

A serious drawback is the lack of plans by CD organizations to use radio optimally and by the radio industry to serve the CD needs in the postattack time period. As part of our research, we visited prominent members of the Massachusetts and New York State Civil Defense Organizations and leaders of the Massachusetts SIAC (see Appendix B). These visits indicated to us that little thought or emphasis has been given to mass communications in the postattack period. In the case of the CD staff members, it was evident that most of the communications planning had been devoted to the warning phase. Too much reliance on a continuance of peacetime operations was also evident.

The radio people, on the other hand, found that present government directions concerning emergency broadcasting were vague, and that the new plan promised long ago had not materialized. The present CONELRAD plan prevents AM radio from reaching an adequate fraction of the population because it includes only some of the AM radio stations, it requires a reduction in power, and it permits only two frequencies to be employed, which may cause interference in some areas. The radio people would like more guidance from the Federal Government and would, of course, like to have expensive equipment changes or additions underwritten. Specialized training of radio broadcasters and engineers to cope with postattack broadcast requirements is, as yet, nonexistent.

Poor Switchboard Setup

Switchboards at radio stations are not set up to handle a large influx of information. These switchboards would present a bottleneck if the CD directors or other officials of a number of communities attempted to funnel their requests for broadcasts into a station simultaneously.

Several Boston radio stations offer their services to Greater Boston community school systems and industrial firms for broadcasts of emergency weather announcements when severe weather requires cancellation of school or work schedules. At least one station, WHDH, found that its switchboard was overwhelmed by the incoming cancellation calls at certain peak time periods. To alleviate this situation, 10-minute time slices (from 6.15 a.m. to 7.30 a.m.) were assigned to

blocks of ten communities for their no-school and no-work announcements. A similar system might be used to assure the timely reception of CD calls by the station's switchboard.

Vulnerability of Transmitter Towers to Blast Damage

The endurance limit of a transmitter tower is listed as 3 psi overpressure.[13] Obviously, there are individual variations depending upon tower height, whether the tower is guyed or not, type of construction, quality of construction, etc. To illustrate the 3 psi overpressure contour in terms of tower destruction, we show in Table 4 the effect upon the ten major transmitting towers (5 to 50 kW) in Boston by bombs of various yields impacting or bursting over the Boston Naval Shipyard.

TABLE 4

BLAST DAMAGE TO BOSTON TRANSMITTER TOWERS

Bomb Yield (megatons)	Type of Burst	3 psi Contour* (miles)	Towers Remaining
5	Surface	6.4	7
	Air (Optimum)	10.6	5
10	Surface	8.1	5
	Air	13.3	4
20	Surface	10.2	5
	Air	16.9	1

*"The Effects of Nuclear Weapons," ed. Samuel Glasstone, United States Atomic Energy Commission (April 1962).

Since most suburbs of our major cities are dependent upon radio signals generated within the cities, it may be seen, as is the case in Boston, that a blow against the city leaves the suburbs virtually without local radio coverage.

Lack of Power

All radios except crystal sets require either ac power, which may be unavailable, or batteries, which may be weak or exhausted. Power stations need fuel, which must be replenished periodically (except for hydroelectric plants), and personnel to keep the plant equipment running. Most power plants maintain a fuel stockpile, so that there would probably be no shortage for a 2 to 4 week period. The operating personnel present a different problem—unless there are fallout shelters available at these plants to house several shift personnel (and, as appropriate, their families) and all the necessary monitoring equipment and controls, these power plants will be inoperable. It would seem prudent, then, to put our reliance on battery operated portable radios that could be prepositioned in shelters. Batteries, however, deteriorate; the normal battery operating life of these sets is 50 to 300 hours. Unless spare batteries are stockpiled or provisions made for recharging those batteries that can be, these radio sets will become useless.

THREE MODES OF OPERATION

Three modes of operation are possible for commercial radio stations and will be described here. The first two modes assume a telephone line between the Emergency Operation Center and either the studio or the transmitter facility of the radio station, backed up by a radio link. Because telephone lines may not be very reliable in the postattack environment, we emphasize the advisability of the radio backup, using equipment in the 450 Mc band for transmission distances not exceeding 15 miles. (This range may be extended by corner reflectors or parabolic antennas and by installing the antennas at high elevations. If much longer ranges are desired, similar equipment in the 150 Mc band may be used, as well as repeaters costing $1200 to $1400.) The 450 Mc equipment is compact, requires only a small antenna, and is relatively inexpensive: an 18 W transceiver and antenna can be bought and installed for approximately $1,000. This equipment is gaining in popularity and is used today by the broadcasting industry for remote pickups as well as by public transportation companies, taxi cab operators, power companies, etc. The third mode of operation outlined below makes use of the mobile 450 Mc gear used by the radio industry.

First Mode — Direct Line to Studio

The first proposed mode of operation is the most common one today. In this scheme, the Emergency Operating Center is linked by an open line to the broadcasting studio of a local radio station. Information is passed over this line to the station where it is broadcasted by a station announcer. Radio backup is not installed anywhere today (to our knowledge) but is, of course, recommended. The advantage of this direct line to the studio lies in the fact that the actual broadcasting is accomplished by a person trained to read messages calmly and intelligibly. We do not imply that the broadcaster should be allowed any liberties with the material conveyed to him for transmission, but only that his training qualifies him uniquely to make announcements clearly and in an unruffled manner. An additional benefit is the assurance given to the populace by listening to a familiar voice. A disadvantage is that additional cost will be incurred in backing up this line with a radio link in cases where the studio and transmitter are not co-located, requiring a second communications line between them.

Second Mode — Direct Line to Transmitter

In the second scheme of operation an open line links the Emergency Operating Center with the transmitter of a local radio station. Here again, there is no radio backup to our knowledge, although this measure is recommended. Announcements are made by CD, town, state, or national officials with presumably untrained and unfamiliar voices, inexperienced in the psychology of commercial broadcasting. On the other hand, there is only one communications link in this system, making it relatively secure physically. An extra consideration here is the shelter available for the broadcasting personnel, for the Emergency Operating Center would presumably offer considerable shelter against fallout. The transmitter sites, too, will eventually be equipped with shelters. The radio studios used in the first scheme, however, would be quite vulnerable (unless protected at considerable expense by the stations themselves, which, in light of recent history, seems unlikely), another reason that the first system is somewhat less secure than this one.

Third Mode — Mobile Van

An alternate or perhaps a supplementary method of broadcasting might be to place in position a remote pickup van at the Emergency Operating Center during

the warning phase, for use in the postattack period. The radio equipment thus provided could be used for communications either with the studio or preferably with the transmitter site of a local radio station. This system offers much the same advantages and disadvantages of the second scheme.

We are not prepared at this time to advocate the adoption of any one of these systems in preference to the other two.* In fact, the choice will be dictated, in many cases, by the local situation and available funds and equipment. We do feel, however, that reliability of communications links and security of the broadcasting source should be the principal consideration in the final choice of a method of approach.

AREA COVERAGE

While there are practically no areas of the United States that do no have reception from at least one commercial AM radio station, the adequacy of coverage for CD purposes remains to be established. We have made a brief survey of the coverage for the Greater Boston Area which indicates that coverage is marginal at best.

Figure 1 shows the Massachusetts Civil Defense areas and sectors. The area we have considered is the Massachusetts CD Area 1 plus Sector 2D which consists of northeastern Massachusetts surrounding Boston. The Greater Boston Area so defined contains twenty-five commercial AM radio stations, nine of which have studios or mailing addresses in Boston itself. The rest are reasonably well distributed throughout the Greater Boston Area. The twenty-five stations are distributed as follows with respect to power output:

Power Output	Number of Stations
50 kW	3
5 kW	8
1 kW	9
500 W	2
250 W	3
Total	25

These stations service a total of 106 towns, each of which contains at least one local CD jurisdiction. The number of towns and cities that are located in each

*A mix of schemes 1 and 2 is also possible in which an announcer could broadcast from the transmitter site.

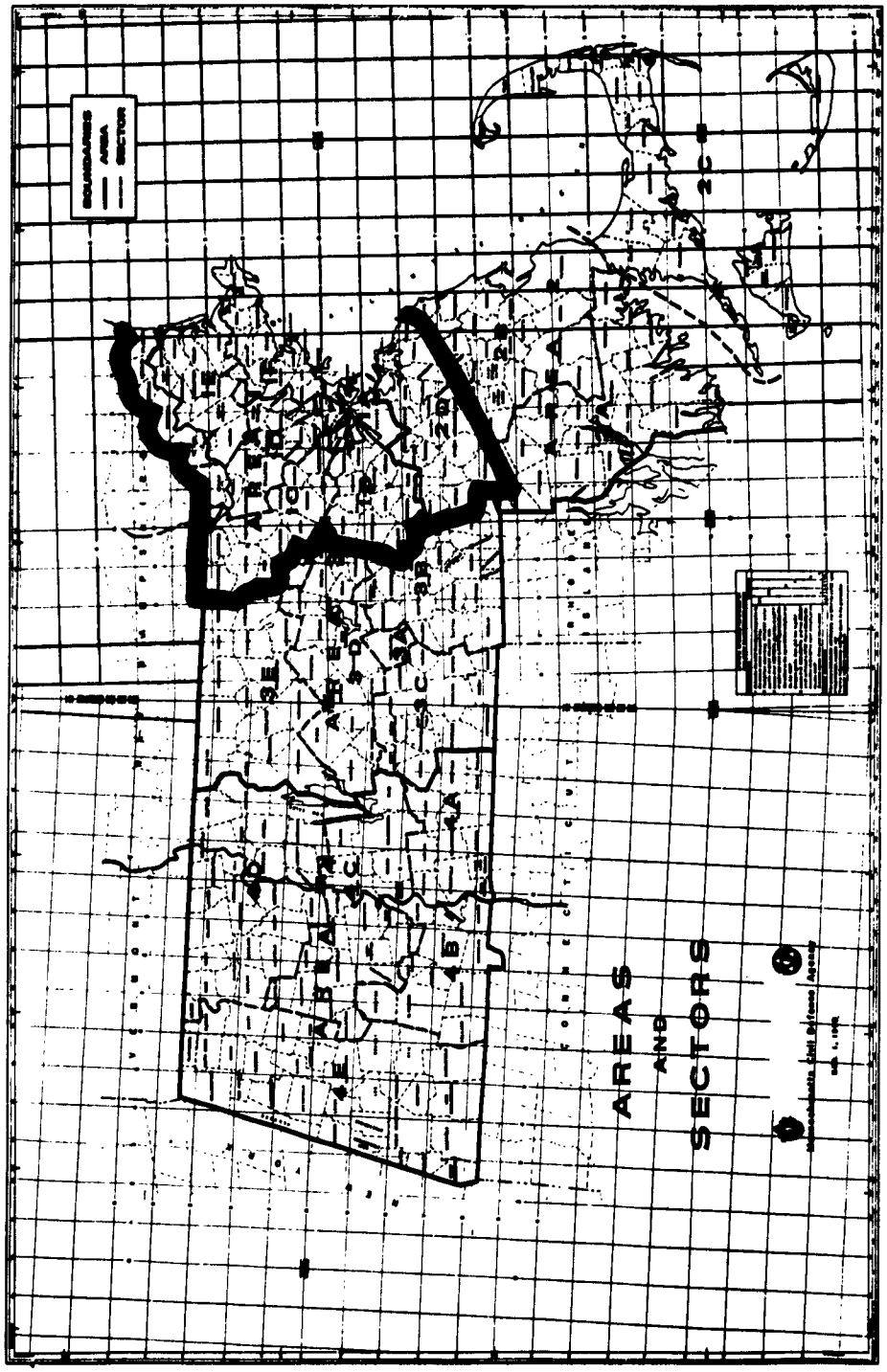

Figure 1. Massachusetts CD Areas and Sectors

sector is as follows:

Sector	Number of Towns and Cities
1A	1 (Boston)
1B	14
1C	16
1D	19
1E	17
1F	18
2D	21
Total	106

Since many of the broadcasting items are of local interest, it is necessary to assign stations to specific localities in view of the heavy total broadcasting requirement. With a straightforward allocation of towns, each station would service roughly four towns (twenty-five stations for 106 communities). This does not take into account the possibility that some of the stations may be knocked out by the attack. If we reconsider the broadcast time required for each locality, i.e., 2 to 3-1/2 hours per day per locality in the BUP, 2 to 4 hours per day per locality in the EP, 2 to 3-1/2 hours per day per locality in the RP, the twenty-five stations, or whatever remains after attack, may not provide enough broadcast capacity to meet local requirements if they are also to broadcast national and state data requiring 4 to 5 hours BUP, 6 to 7 hours EP, 4 to 5 hours RP.

The picture may not be as black as depicted above. First, a more exhaustive and quantitative analysis of requirements than was possible in this study might reduce the number of hours of broadcasting substantially. Second, during the EP and RP, there is a possibility of using other means of information dissemination than radio, since the state of complete immobility typical of the BUP does not exist in these later periods. Loudspeakers and printed instructions, for example, could carry some of the load. Also, the urgency of dissemination during the EP and RP is less than during the BUP.

Because information requirements are divided into two groups, for the local and mass audiences, efficient use of the total broadcast time available indicates that

division of the broadcast responsibilities of stations by information content is warranted. That is, for the Greater Boston Area, the responsibility for carrying the national and state information of common interest to all localities could be allocated exclusively to the three 50 kW stations and enough of the 5 kW stations to cover the Area. The other stations would each have responsibility for several specific localities close to their transmitters. Such organization of stations would require the reception of information from two sources rather than one, but would reduce the duplication of broadcast of national and state data. Since the use of all stations in the Area seems to provide only marginal coverage at best, any limitation of the number of stations used in the postattack period or limitation of the frequencies or power transmitted will tend to reduce the amount of useful information broadcast or will prevent some listeners from receiving information.

AM TRANSMITTERS AT LOCAL OR SECTOR EMERGENCY OPERATING CENTER

We have considered the possibilities of constructing AM transmitters in the standard broadcast band at the local or sector CD Emergency Operating Centers both as an alternative and supplement to the existing commercial plant. Since most EOC's are located in shelters that offer considerable fallout protection (some also offer blast protection), this concept eliminates the problem of providing separate hardening for transmitters and studios and also eliminates the problem of providing secure communication links from EOC's to transmitters. If the EOC is lost, no sources of local data exist. Also, since the facilities would be manned by CD personnel, the problem of insuring manning by and training of commercial station personnel would be eliminated.

When this concept is considered as an alternative to commercial facilities, the cost of such an installation must be traded off against the cost of secure communications between the EOC and the commercial transmitter (probably an FM link), the cost of hardening the commercial transmitter, and the advantage of having the EOC transmitter listed above. While the cost of a transmitter at a single

local EOC is not great, the large number of localities in the United States implies a substantial total investment. The modified concept, transmitters at sector EOC's, implies the greater unit cost of more sophisticated equipment and the requirement to use CD point-to-point communications to carry local data up to sector for broadcast.

As a supplement to the commercial plant, the local EOC transmitter offers clear advantages over the alternative of airborne or other supplementary mobile transmitters. Broadcast stations such as the ones proposed here could not be set up under present FCC regulations. Specifically, rules pertaining to minimum operation schedule, minimum operator requirements, tower height, and cochannel interference would have to be waived.

CONFIGURATIONS AND COST

A local installation depending on size would require a transmitter of 100 W or less, while sector installations covering several localities would require more powerful transmitters. Table 5 lists the costs of transmitters currently available.

TABLE 5

COST OF TRANSMITTERS OF VARIOUS POWER CATEGORIES

Power (watts)	Cost (dollars)*
50	$ 650
100	1,995
250	3,090
500	4,250
1,000	4,525
5,000	13,700
10,000	17,250
25,000	44,900
50,000	89,500

*In each case, the cost quoted is the lowest price submitted by four of the major manufacturers, RCA, Bauer Electronics Corp., Collins Radio, and ITA Electronics Corp.

The other costs in such an installation are antenna, auxiliary power supply, and miscellaneous equipment for broadcasting and maintenance. Three alternatives exist for local EOC antennas: a standard guyed steel tower, a half wavelength

horizontal dipole, and a single vertical grounded wire of 1/8 wavelength or less. (A kytoon-hoisted 1/4 wavelength antenna could also be used.) The costs for guyed steel towers are given in Table 6.

TABLE 6

COST OF GUYED STEEL ANTENNA TOWERS

Tower Height (ft)	Total Cost (Installed)	Ground System Cost (Installed) (120 radial copper wires 1/4 λ long)*	Total Cost
100	$1606	$ 400	$2006
200	3045	800	3845
300	4416	1200	5616

*Cost figures are supplied by RCA.

The half-wave horizontal dipole would require a wire of 850 ft for 550 kc and 292 ft for 1600 kc. The use of a simple, short (40 or 50 ft) vertical wire entails some loss of field strength as compared with longer antennas, but the cost of such a system consists almost entirely of the ground system. In addition, such an antenna could be erected in a few minutes after any danger of blast effect has passed. Figure 2 (derived from ref. 14) shows the field strength of vertical grounded antennas as a function of their height.

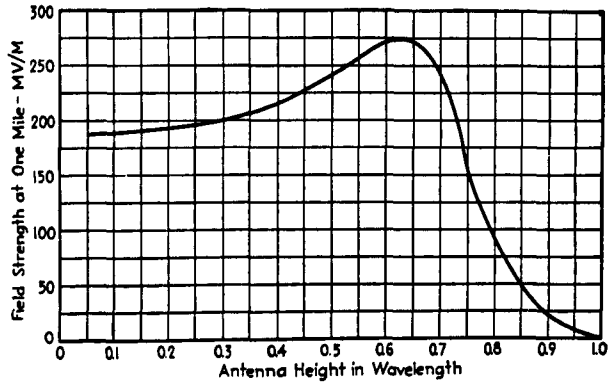

Figure 2. Antenna Field Strength Along the Horizontal as a Function of Height for a Vertical Grounded 1 kW Radiator

Auxiliary power generators increase considerably in cost as their power capacity is raised. Table 7 shows the costs of different generators and the size of transmitters they might drive. The power needed to drive auxiliary equipment such as heating plant, lights, air conditioning, etc., is included in the ratings.

TABLE 7

COST OF GENERATORS FOR VARIOUS TRANSMITTERS

Power Plant Capacity (watts)	For Transmitter	Cost*
500	100 W	$295 to 345
700	100 W	375
1,000	250 to 500 W	405 to 475
10,000	1 kW	1420 to 1575
40,000	5 kW	5,000
200,000	50 kW	15,500

The costs of miscellaneous equipment are as follows:†

AM Frequency Monitor	865
Modulation Monitor	625
Limiting Amplifier	620
Monitor Amplifier	215
Tape Recorder	500
Microphone, Cabinet Rack, Etc.	375
	$3,200

*Quotations are from Kohler Electric, Onan Electric, Cummins, and Caterpillar Diesel.

†Cost estimates are based on quotations submitted by RCA.

To supply adequate field strength for a town like Lexington, the transmitter system would consist of a 50 W transmitter, a short (40 or 50 ft) vertical grounded wire antenna, a 500 W auxiliary power supply, plus the required items of miscellaneous equipment, priced as follows:

Transmitter	650	
Antenna (ground system)	500	
Power Plant	290	
Miscellaneous Equipment (limiting amplifier, monitor amplifier, microphone, cabinet rack, etc.)	1,210	
Tape Recorder (optional)	(500)	
Total	$2,650	($3,150 if tape recorder included)

An installation at a typical sector EOC would consist of the following items: a 250 W transmitter, a 200 ft guyed steel tower antenna, a 1000 W auxiliary power supply, plus the required items of miscellaneous equipment:

Transmitter	3,090
Antenna	3,845
Power Plant	405
Miscellaneous Equipment (this equipment consists of the items listed in Table 6.)	3,200
Total	$10,540

PUBLIC ADDRESS SYSTEM

It has been suggested that the requirement for a mass communications medium for the postattack era might be fulfilled by a public address system such as has been installed at L. G. Hanscom Field, Bedford, Massachusetts, and in the Town of Braintree, Massachusetts. These two systems are manufactured by the Fyr-Fyter Company and were installed by its New England agent. The Fyr-Fyter system consists of a command console with microphone and five zone-selection switches. The console is battery-driven and has an ac battery charger. Only one console is required per system. The loudspeakers, four per pole installation, are 75 W speakers with an approximate range of 1/4 mile. The four speakers give 360° coverage. The pole installation also includes a 200 W amplifier in a weatherproof cabinet and a 12 V battery and battery charger. As many poles as necessary may

be installed. The console and poles are linked by leased telephone lines, but could also be connected by radio equipment such as 450 Mc band gear. The system will operate up to 48 hours on battery power if used very sparingly. Siren as well as voice transmissions may be utilized.

The cost of the various system components is as follows:

Items	Cost
Console	$1,300
Pole installation (each)	1,100
Pole (installed)	110
Leased lines/month (each)	10

For the Town of Lexington, we calculate that such a system would require thirty pole installations and would cost:

Cost of one console	$ 1,300
Cost of 30 pole installations	33,000
Cost of 30 poles	3,300
Total nonrecurring cost	$37,600
Annual leased line cost for 30 lines	$ 3,600

Although a public address system such as this offers some very distinct advantages, it has overriding liabilities which in our opinion make it undesirable as a postattack information medium. This does not imply that as a warning scheme it is not adequate. Let us deal with the advantages first.

ADVANTAGES

The following are the advantages of a public address system for broadcasts in the postattack period:

1. The system can be operated directly from the EOC and needs no communication channels from signal originator to transmitter.
2. The equipment can be turned on when it is required and, because of its nature, immediately commands the attention of the listener.

(Unlike radio, it does not depend upon the fortuitous circumstance that the listener has turned on his set when information is directed to him.)

3. Selected areas may be addressed individually by means of zone selection switches on the console.

4. The system may be used for purposes other than its prime intended function. That is, it could be employed as a fire warning system, a system for warning of local disaster, or even for playing music on holidays.

DISADVANTAGES

The disadvantages are as follows:

1. The battery life is very short and in the event of a commercial power failure, the pole installations would become useless after a few announcements.

2. Sound is attenuated by wind and solid obstacles. The walls of fallout shelters would present a serious obstacle to sound propagation and the advertized 1/4 mile range of the speakers becomes much less.

3. Telephone lines may go out, thus nullifying the system.

4. The system is expensive. For the same cost of a Fyr-Fyter system in Lexington, the town could install a 250 W transmitter and purchase and distribute 1000 portable battery-operated $25 radios (one radio for every seven homes). An additional 145 radios per year could be added out of the $3600 which would have to be appropriated to telephone line leases. (We do not advocate that Lexington install its own transmitter and hand out radios, but we make this comparison to illustrate the high cost of the public address system.)

To summarize, the public address system, despite certain desirable benefits, is a less than optimal, comparatively expensive, and perhaps short-lived arrangement.

MOBILE BROADCASTING STATIONS

If we consider the possibility of relatively large areas being devastated or isolated by a thermonuclear attack upon this country, then the problem of informing the survivors in these areas looms quite large. One possible solution to this dilemma is the employment of an airborne standard AM broadcast transmitter.

AIRBORNE STATIONS

A 250 w transmitter and associated equipment could be carried easily by older aircraft such as the DC-3 or DC-4, which are now plentiful in the surplus market and are relatively inexpensive. The transmitter, associated gear, and personnel would weigh less than 3000 lbs permitting these aircraft, with extra fuel, a loiter capability in excess of 7 hours for the DC-3 and 12 hours for the DC-4. Transmitter and aircraft modification kits could also be stockpiled at several locations to be installed in transport aircraft as required. The transmitter-equipped aircraft could be hangared at small fields in areas of the country considered safe. When the need arose, these airplanes could be flown to the stricken areas and could circle for several hours making broadcasts. A trailing wire 1/2 λ antenna would provide sufficient signal strength to cover a large metropolitan area and its immediate surroundings. Aircraft equipped with transmitters could also serve as relay points in efforts to broadcast CD messages across the country.

VAN TRANSPORTABLE STATIONS

A smaller station with a 100 w or 250 w transmitter could easily be fitted into a 2-1/2 ton truck, with perhaps a second smaller vehicle carrying a telescoping antenna tower or several Kytoon sets. These vans could be brought to the edge of a devastated area and used to cover a small region at a time.

It should be noted that neither of these portable transmitter schemes is proposed as a substitute to reliable local radio coverage supplied by a fixed station.

EMERGENCY ANTENNAS FOR COMMERCIAL RADIO TRANSMITTERS

Several means might be used to provide backup for commercial station antennas in the event of damage to these highly vulnerable components. One possibility consists of hoisting a finned balloon similar to a barrage balloon, such as a Kytoon. These Kytoon balloons are available in various sizes and price ranges; the 82 cubic foot Kytoon with a lifting power of 4 to 10 lbs (depending upon wind speed) costs $122.60.* Kytoons are quite stable, head into the wind, and, in fact, derive additional lifting power from the wind. Their airfoil construction prevents them from spinning and, under normal wind conditions, from blowing to the ground like an ordinary round balloon. They need reinflation approximately every 48 hours,† however, which would be rather difficult to accomplish from a fallout shelter. Instead, seven or eight Kytoons could be kept on hand for replacement when deflation causes the antenna to sag badly or when the balloon is in danger of being fouled by a tree or building. Transmitters up to 5 kW might employ such antennas using 6 or 8 gauge cooper wire. The weight of a 150 ft length of 6 gauge wire is 12 lbs and could easily be lofted by two or three Kytoons depending upon wind conditions. The 8-gauge antennas could be lofted by one or two Kytoons.

A more sophisticated but also much more expensive method of hoisting aloft an antenna wire is provided by the "Helevator" rotary wing vehicle now being developed by Fairchild Stratos. This vehicle is driven by a 40 hp electric motor (requiring 40 kW power) and is capable of lifting 150 lbs to 1000 ft. Actually, this capability is somewhat in excess of our requirements since we need to ascend no higher than 500 ft and lift no more than about 50 lbs. The vehicle will, by means of an integral autopilot and control system, stay directly above the transmitter, keeping the antenna vertical in winds up to 45 knots. Endurance is 1000 hours. Unit system

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*A quotation made by engineers of the Dewey and Almy Chemical Division of W.R. Grace Company.

†This figure is representative of Kytoons only. Other similar balloons may have different endurance characteristics. Kytoons are also adversely affected by rain and snow.

price in lots of ten is $95,000,* making this vehicle rather expensive. To this cost must be added the extra expense of the additional capabity required of the station's power generating plant to fly the vehicle.

The "Helevator" looks like the ideal solution to the antenna problem. It has the necessary capacity, is reliable, has endurance, is simple in its operation, but it is very expensive to buy and operate.

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*Quotation by Fairchild Stratos, Electronic Systems Division, Wyandanch, N.Y., 15 November 1962. This price includes the vehicle, power cable, landing platform and winch. Unless this vehicle is first produced for some other customer, design and development costs of $170,000 and prototype costs of $150,000 would also have to be absorbed.

CHAPTER 4

REQUIREMENTS FOR RECEPTION OF INFORMATION BY POPULACE

For postattack broadcasts to reach the population, there must be sufficient receivers capable of acquiring the radiated signals, amplifying them, and then disseminating them to the sheltered audience. Each family shelter should be equipped with at least one battery-operated radio of modest capability backed up by one or more sets of spare batteries. Larger community shelters, however, will need more powerful instruments and in many cases more than one receiver so that the entire population of the shelter may listen at the same time. (An alternative to having more than one radio might be to feed one good set into the public address system of the community shelter.) These radios may be ac sets if the shelters have auxiliary power generators, but should be battery sets where no emergency power is available. Sufficient spare batteries to allow continuous operation of at least one set for 4 weeks should be stockpiled.

The most recent statistics[10] indicate that 97.9% of all homes have working radios. Unfortunately, we were not able to determine what percentage of these radios (184,000,000 radios with an average of 3.4 per home) were battery-operated sets. However, it would appear that approximately one third of these receivers are portable battery-operated instruments. Just what the actual distribution is we do not know exactly, but it is clear that portable sets are gaining in popularity and represented 48% of all sets sold in 1961.[9]

At present, there are no Federal provisions to include among the survival items of a community shelter a radio, either battery- or ac-operated. Such an oversight should be rectified. Each community shelter should be stocked with sufficient radios commensurate with its expected population and with spare batteries where applicable. Although it may be argued that surely some people will bring radios to the shelter, we cannot count on this nor upon the life expectancy of the batteries that might be in any of these radios. Nor can we count on the ability of these radios to operate in underground shielded buildings without the aid of outside antennas. There is no substitute for a federally-directed stockpiling program.

To get the best results from the postattack broadcasts, a training and information program should be instituted as soon as plans and schedules are formalized. We have in mind a campaign similar to the one that has been conducted for some years to acquaint the American public with the two CONELRAD frequencies. Schedules, types of programs to be expected, and the preparations necessary for the reception of these programs might be disseminated. People should be instructed to constantly monitor their sets during their stay in the shelter (battery reserves permitting). Above all, they should be urged to place battery-operated radios in their shelters and to maintain a stockpile of reserve batteries for these sets. People also might be instructed to store spare batteries in refrigerators to enhance their shelf life. Reading material especially prepared to supplement the instructional broadcasts could also be stockpiled.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. The proper and timely dissemination of information to a population surviving a major disaster provides a potential for the saving of a great many lives. This is particularly true of post nuclear attack survivors who will, in their shelters, depend upon this information for news of the outside world as well as instructions for shelter subsistence. Radio is the logical choice for an information communication tool in the postattack period because:

   a. Good coverage of the nation by the existing broadcasting facilities is now effected.

   b. Almost all homes are equipped with AM radio receivers. Many of these sets are battery-operated.

   c. Radio appears to be the only means of communications capable of injecting information into a shelter during the BUP (assuming that telephone lines are vulnerable or unavailable).

   d. Much of the information necessary to the populace in the postattack period is of a perishable nature, that is, it must be communicated quickly to retain its value. AM radio is capable of achieving this timely dissemination.

2. A great deal of the survival information to be broadcasted is generated at the local level and must be disseminated locally. There are, at present, no special plans or facilities designed to accomplish the broadcasting of local information. It is true that commercial telephone links between EOC's and radio stations exist, but these are vulnerable and are subject to maintenance.

3. There exists no allocation scheme that assigns specific radio stations to local CD jurisdiction, although such an assignment is imperative for efficient local coverage. One reason why such an assignment is difficult to accomplish is that local broadcast requirements have not been defined, and thus no load estimates for the stations can be made.

4. If, however, our estimates of requirements and resultant schedule are correct, then the existing broadcast installations will be taxed to cope with this load. It is clear, therefore, that any broadcast system that restricts the full capability of the broadcast plant, such as CONELRAD, will provide inadequate coverage. The most detrimental CONELRAD restrictions are those limiting the number of stations allowed to broadcast, the requirement for reduction of broadcast power, and the mandatory use of only two broadcast frequencies.

5. Fallout protection for broadcast personnel, both announcers and engineers, must be provided. The OCD has initiated a program that, in its initial phase, will provide shelters at seventy-six commercial AM broadcast stations, representing 2 per cent of the 3693 stations in operation. This is a small beginning, but it is a definite step in the right direction. The floor space of these shelters (150 sq. ft.) is small, probably not enough to house several shift personnel (and members of their families), but should be adequate to provide a minimal capability.

6. The broadcast equipment and power sources used must be reliable and backed up by sufficient spares to allow prolonged uninterrupted operation. The electronics equipment utilized by commercial stations today is extremely reliable and will operate without failure for periods of about 4 weeks. FCC regulations require that broadcasters keep on hand a supply of spare tubes, so that failure due to breakdown should not present a problem.

   One of the prime requirements for assurance of continued broadcasting is electric power. It is undoubtedly essential that those radio stations needed for total coverage of the nation's populated areas be equipped with standby power generators to take over if and when commercial power fails. This is not the case today, in spite of the fact that virtually all radio stations participating in the CONELRAD operating system do have emergency power plants. Emergency generators should have sufficient capacity to operate the transmitters at full power (not true of most CONELRAD stations) and also to run all other electric equipment necessary for continued operation of the station (lights, ventilation fans or air conditioning, heating systems, etc.).

The station must also have a reliable signal radiator. Most commercial radio stations employ two or three towers to obtain a directional pattern. In the event of the failure of one of these towers, omnidirectional signal generation is possible from just one of the towers. (The tuning elements of the individual towers may have to be replaced with larger ones capable of handling the transmitter's full power output. Remote tuning of the antenna must also be provided.) Smaller stations, however, employing only one tower, have no convenient backup in case of failure.

7. Reliable communications between the signal source (broadcaster or EOC) and transmitter are required. At present it is the practice of the radio industry to employ leased telephone lines for this purpose. These lines, as pointed out above, are not reliable.

8. The existence of stockpiles at broadcasting centers of both written and prerecorded material is essential to the efficient dissemination of several classes of messages. The material prepared today consists primarily of recorded CONELRAD announcements and speeches by national and state leaders. A great deal of effort needs to be expended in this area now, because last-minute improvisation and agglomeration must be avoided. The message category which lends itself most conveniently to an immediate effort and which has been most neglected is that of self-help instructions.

9. Much thought and effort has gone into the development of warning schemes, but the postattack information problem has suffered neglect. There is little point to alerting the population, guiding it to shelter, and then abandoning it there without a word from the "outside." To employ to the best advantage the facilities, personnel, materials, and plans available in the postattack era, detailed plans for the utilization of this vast complex must be developed.

   Although local, state, or regional plans would be helpful, plans of a national scope would be far more effective. National networks are required to disseminate information originating from Washington, Colorado Springs, or perhaps Omaha. Transcontinental relaying of messages encompasses the nation. The overlapping and wide coverage (particularly at night) of some stations emphasizes the national character of the problem. We have, in the radio industry, a

national resource which we should use to the fullest. We do not mean to belittle local and state plans for radio coverage; these are very important indeed and must be implemented, but the "grand design" should come from the Federal level. A plan for postattack mass communications should be originated by agencies of the Federal Government (OCD, FCC), including within it provisions for all the lower echelons down to and including the local level.

RECOMMENDATIONS

We have indicated the considerable capacity and potential inherent in the commercial AM broadcasting system of the United States. Not to utilize this available resource to the fullest in our attempts to inform the survivors of a thermonuclear attack would indeed be imprudent. The weaknesses and deficiencies in our present system must be identified and corrected. The following steps are recommended in light of the conclusions drawn above:

1. A master plan must be established for the optimal utilization of the nation's broadcasting capability in the postattack era. This plan should provide guidance at the Federal level and specify implementation procedures at all levels—local, sector, area, state, regional, and national.

2. Fallout shelters (and in particularly vulnerable areas, blast shelters) should be provided at sufficient AM radio stations to assure coverage for the entire nation, with backup by a second station provided for each broadcast area. These shelters should be large enough to house sufficient personnel and supplies (food, medicines, etc.) including spares to allow selfsustained operations for 3 to 4 weeks. The program to establish fallout shelters in a few stations with Federal 1962 funds should be speeded up and expanded until complete coverage is gained.

3. Each of the selected stations should be equipped with a power-generating plant with sufficient capacity to handle the load imposed by the station's equipment for 3 to 4 weeks. Fuel supply for this time period should be maintained constantly.

4. All radio stations should have a backup antenna or alternate means for radiating their signals. For local stations as well as those larger ones located in strategic areas where they are likely to lose their whole complement of antenna structures, some backup means of lofting an antenna should be provided. Either a Kytoon balloon or a Helevator vehicle might be used, or a pole or long wire, pre-strung, connected via a switch when necessary.

5. Program material must be developed, scripted, recorded where appropriate, and distributed to the selected stations.

6. FM equipment in the 450 Mc band, or where necessary in a lower band such as the 150 Mc or even the 26 Mc band, should be installed at the EOC's and at selected radio stations to assure communications.*

7. Consideration should be given to the installation of an AM transmitter at the EOC in areas where adequate coverage cannot be provided by commercial AM radio stations (perhaps the closest AM station is still too distant to provide coverage, or commercial operators refuse to participate in the program, or stations are vulnerable to attack).

8. Mobile and/or airborne (preferably the latter) transmitters should be located in "safe" areas, to be moved to disaster areas as the need arises.

9. Each broadcasting area should have associated with it either a Civil Defense Headquarters or an Emergency Operating Center located in a fallout shelter adequately manned and equipped.

10. The CONELRAD system must be modified to allow radio coverage of the entire population. More stations should be included in the system, normal operating frequencies should be employed, and power should be reduced only to eliminate serious mutual interference.

11. Extensive effort should be devoted to an intensive study of local, state, and national message requirements for the postattack time period. Simulation

*These bands are as follows: 25-54 Mc, 144-174 Mc, and 450-470 Mc.

and war-gaming are applicable tools for this purpose. Once the requirements have been ascertained, a scheme for assignment of radio stations to CD jurisdictions (or EOC's) should be developed in order to close this important planning gap.

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APPENDIX A

LEXINGTON

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LEXINGTON

The Town of Lexington (incorporated 1713) is one of the so-called "bedroom communities" surrounding Boston, Massachusetts. The town is primarily residential but contains within its confines the main offices of the Raytheon and Itek Companies, a portion of L. G. Hanscom Field including the MIT Lincoln Laboratories, as well as a number of other office buildings. There is no light or heavy industry, but the town affords sufficient employment in its office, commercial, and educational complexes to practically equalize the daytime and nighttime population.

The town's government consists of an elected Board of Selectmen supplemented by an annual Town Meeting with elected town-meeting members. The Director of Civil Defense is appointed and maintains an office, staffed with one full-time secretary, in the town office buildings. The town has equipped an Emergency Operation Center, which is located in the basement of the same building that houses the Civil Defense Office. The Center is located in a large room affording a protection factor of more than 1000. Ample work space is provided for the operating personnel, with special tables and communications equipment for the fire, police, and public works departments. A small, separate communications center adjoins the main room and is equipped with a transceiver in the 150 Mc band common to the fire, police, and public works departments, as well as three Gonset sets in the 2, 6, and 10 meter bands provided for the RACES operators.

Listed below are some of the more pertinent statistics describing the Town of Lexington:

Population (1960)	27,691
National Shelter Survey Spaces	18,510
Area	16.64 sq mi
Extreme length	5.8 mi
Extreme width	4.85 mi
Number of family dwellings	7,105
Highest elevation	385 ft
Lowest elevation	110 ft

Public streets and highways	108.56 mi
Hospitals	None (closest is approximately 4 mi from center of town)
Fire stations	2
Water supply	4 entries from MDC, one 24 inch and three 16 inch pipes feeding water towers
Electric power supply	2 Boston Edison 13,800 V substations
Distance from Boston (downtown)	11.5 mi
Annual births (1961)	391
Annual deaths (1961)	352
Incidence of communicable diseases reported (1961)	991
Number of physicians (1961)	26.

Radio reception in Lexington is good because most of the populated areas are on high ground, and, in addition, a number of radio transmitters are close by. One transmitter of a 5 kW station is located in the town 2-1/2 miles from the EOC, and another transmitter of a 50 kW station, although located in a neighboring town, is only 3 miles away.

Figure A-1 is a map of Lexington, an area of 16.64 square miles. Figure A-2 shows the surrounding environs of Lexington. Radio transmitters of from 5 to 50 kW are pinpointed; the Massachusetts Civil Defense Headquarters at Natick is delineated by the triangle in the lower left corner.

Figure A-1. Map of Lexington

Figure A-2. Map of Lexington and Surrounding Area Showing 5 to 50 kW Radio Transmitters

APPENDIX B

FIELD TRIPS

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FIELD TRIPS

On 3 September 1962, staff members of Technical Operations Research paid a visit to the office of Region I, Department of Defense, Office of Civil Defense, located at Harvard, Massachusetts. Discussions were held with Mr. Fred Olson, the Radiological Officer, and Mr. Charles McLeod, the Communications Officer. Both these gentlemen told us that regional headquarters have no requirement for AM broadcast band communications, but rather that this is the responsibility of the state and local CD jurisdictions.

Because it was evident to us that the national and state Industry Advisory Councils play an important role in the definition of emergency broadcasting procedures, we thought it appropriate to interview a member of the Massachusetts SIAC. Accordingly, on 10 September 1962 we arranged to talk with Mr. Irving Robinson, Chief Engineer of Radio Station WNAC, Boston, who has been quite active in Civil Defense matters. Mr. Robinson informed us of the status of CONELRAD (still in force but future uncertain) and discussed with us the mechanics for disseminating throughout the state the signals originating at the Massachusetts Civil Defense Headquarters. Primary and emergency means of signal distribution were reviewed. Mr. Robinson also discussed with us the role the commercial broadcaster should play (in his opinion) in postattack radio broadcasting.

The following day, 11 September 1962, we met with Mr. Fendt Langston, Chief of the Communications Section, Massachusetts Civil Defense Agency, at Natick, Massachusetts. We discussed with him the organization of the Massachusetts CDA and its plans for mass communications in the postattack era. Mr. Langston told us that he had a direct line to Station WNAC and would thus be in a position to distribute considerable information, but that no firm plans, scripts, or recordings are now in existence for postattack broadcasts except for recordings of messages by the Governor, the Speakers of both Houses of the State Legislature, and the State CD Director. No preparation has been made for an alternate means of distributing a signal to the radio stations, should these telephone lines go out.

On 21 September 1962 we interviewed Mr. Authur Burrell, the Civil Defense Director of Lexington, Massachusetts. Mr. Burrell's office is located in the Town Office complex and is staffed by one full-time secretary. An Emergency Operating Center, well equipped, is located in the basement of the same building. We discussed with Mr. Burrell the question of mass communication in the postattack time period, and found that Mr. Burrell had no plans for communications with commercial radio stations, although some thought had been given to building an AM transmitter to serve the town in emergencies. He also is waiting to assess the effectiveness of the Braintree, Massachusetts, public address system. The town's radiological monitoring and communications system was outlined to us.

A meeting of Massachusetts Civil Defense directors was held in Lexington, Massachusetts, on 22 September 1962 under the auspices of the U. S. Civil Defense Council. We attended this meeting to acquaint ourselves with the CD preparedness throughout the state. Unfortunately, the meeting was rather poorly attended, and it was not possible to gain a truly representative impression. However, we were able to talk to several local CD directors and learned that not one of them had a plan for disseminating information to the populace after an attack.

To learn whether the Programming Committee of the Massachusetts SIAC had prepared any programs for a national emergency, an interview was conducted with the Committee chairman, Mr. John Day of WHDH, on 25 September 1962. Mr. Day indicated that no program material had been prepared except for the standard CONELRAD messages. Mr. Day discussed with us the problems of funneling into a radio station a large number of messages originating at diverse sources, as might be generated by suburban CD headquarters around a larger city.

On 2 October 1962 we paid a visit to the New York Civil Defense Commission in Albany, New York. Interviews were held with Mr. Joseph P. Hennessey, Deputy Director; Mr. Frank Cowan, Chief of the Communications Section; Mr. Arnold Grushky, Assistant Director for Resources and Production; Mr. William F. Trolenberg, Chief of the CRB Defense Service; and Mr. P. Flemming, Chief of the Public Relations Section. Although we had been led to believe that New York State was more advanced than Massachusetts in its Civil Defense posture, we did not find this to be true for information dissemination in the post-thermonuclear attack period.

No prepared broadcast material exists with the exception of some recorded statements by Governor Rockefeller. The only input into the state's broadcasting facilities is one telephone line to an AM radio station and one telephone line to an FM station of the Northeast Radio Network, the emergency FM network for New York State. No backup is provided. No New York State radio station has a fallout shelter; yet the chief of the CRB service is relying upon CONELRAD stations to broadcast his fallout advisories. Opinions on ideal or desired broadcasting systems were solicited from various staff members.

APPENDIX C

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Technical Operations Research, Burlington, Mass. Office of Civil Defense, Department of Defense, Washington, D.C. Final Report, 7 January 1963, 74 p. incl. 4 figs., 7 tables.

Unclassified Report

This report concerns a study of the requirements for mass information dissemination following a thermonuclear attack upon the United States. The individual information requirements deemed necessary are listed, and AM radio is discussed as the logical disseminator of this information. The discussion centers on the existing AM standard broadcast radio network, including unique transmitters that might be located at emergency operating centers and on mobile radio stations. After the essentials of an efficient broadcasting system for the postattack period are determined, they are compared to those of the existing system. It is concluded that postattack information broadcasting is essential to the survival of the shelter population and may be accomplished by a modification of the present system, including the hardening of broadcasting sites and the addition, where necessary, of special-purpose transmitters. Recommendations for changing and supplementing the radio network of the United States are made.

(over)

1. The Civil Defense Role of Radio Broadcasting the Postattack Period
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9. Contract OCD-OS-62-31

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THE CIVIL DEFENSE ROLE OF RADIO BROADCASTING IN THE POSTATTACK PERIOD.
Technical Operations Research, Burlington, Mass. Office of Civil Defense, Department of Defense, Washington, D.C. Final Report, 7 January 1963, 74 p. incl. 4 figs., 7 tables.

Unclassified Report

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